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Effects of strain and structure defects on the spectrum of electromagnetic excitations in microcavities lattice

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Recent experiments and theoretical investigations reveal an intense interest for photonic structures and systems of coupled microresonators, whose applications include fabrication of clockworks of unprecedented accuracy as well as the sources of coherent irradiation. A number of our recent works have been devoted to photonics of imperfect structures and to the dispersion of exciton-like electromagnetic excitations in non-ideal lattices of coupled microresonators. Designing and utilization of novel materials for manufacturing of the sources of coherent irradiation is currently a vast interdisciplinary area, which spans various theoretical and fundamental aspects of laser physics, condensed matter physics, nanotechnology, chemistry as well information science. The physical realization of corresponding devices requires the ability to manipulate the group velocity of propagation of electromagnetic pulses, which is accomplished by the use of the so-called polaritonic crystals. The latter represents a particular type of photonic crystals featured by a strong coupling between quantum excitations in a medium (excitons) and optical fields. We considered 1D polaritonic crystal as a topologically ordered system-chain of coupled microcavities containing quantum dots. This chain of identical cavities contains randomly embedded quantum dots of two types. Moreover, these microcavity-resonators are also randomly removed at distances between the nearest neighbors. The peculiarities of the polariton spectrum in the 1D lattice of microcavities caused by uniform elastic deformation of the structure are considered. It is shown that as a result of elastic deformation and structure defects in the system it is possible to achieve the necessary changes of its energy structure and optical properties caused by the restructuring of the polariton spectrum.

Biography

Vladimir V Romyantsev is Professor in Nanophysics Department at Donetsk National University (DonNU) and Head of Physics Technology Subdivision at AA Galkin Donetsk Institute for Physics and Engineering (DonPhTI). He received PhD in Physics (1988) from DonNU and Dr. Sci. in Solid State Physics (2007) from DonPhTI. He has published more than 250 scientific publications. He is a member of the American Physical Society as well as Mediterranean Institute of Fundamental Physics (MIFP, Italy) and Editor-in-Chief of Journal of Photonic Materials and Technology (Science PG, USA).

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